of references, and probably would be first if the number were considered in proportion to area. The references for Chile and Peru are about equal in number, and occupy third place.

The scattered nature of the material is strikingly apparent. Observations are taken here and there, and for periods of only a few years, or even only a few months. Weather bureaus are founded bravely, only to be transferred from one government department to another, or to be left on the hands of a group of enthusiasts.

Miss Welch's work places easily at hand the material for the correlation of these fragmentary data, and should lead to a far better understanding of South American climate.—*Preston E. James.*

GROWTH OF TREES [1]

Extended measurements of the growth of many trees of a number of species have been made by the use of the newly designed dendrograph, which makes a continuous record of changes in diameter, and the recently perfected dendrometer, which registers total change in circumference. It is found that the period during which growth takes place even in equable climates with indeterminate seasons does not extend over more than two or three months, and that growth is not rythmical in any sense, but depends upon food-supply, temperature, moisture and other environmental conditions. Awakening of buds, formation of leaves and flowers, and elongation of branches may occur many days or even weeks before trunks begin to enlarge. The leaves of a beech tree in Baltimore began to unfold April 10, 1919, and enlargement of the trunk began about May 18. Daily equalizing variations by which a tree may be actually smaller in mid-afternoon than at sunrise are greatest in the ash, pine, spruce, fir and walnut, and least in poplars, sycamore, beech and oak trees. Accurate measurements of the changes in trunks internal to the growing layer show that these variations are directly connected with the mechanism of the ascent of sap and are explainable upon the assumption of a rigid water column in a trunk composed of wood-cells and vessels capable of some shrinkage and expansion. Crudely expressed the trunk behaves like a heavy hose feeding from a pressure system to a fire engine. When the engine tends to take water faster than supplied, the hose tends to collapse; when the engine slackens its action, the hose swells.—*D. T. MacDougal.*

THE GRASSES OF THE PLAINS

Realizing that I am woefully ignorant regarding the grasses of my own country, yet the article by Mr. Redway beginning on Page 101 of the July-August BULLETIN impresses me with its inaccuracies. He says that "Turf grass does not grow naturally in this region for the reason that it cannot survive the summer drouths." I do not know just what he means by "turf grass," but I do know that many of the grammas, buffalo grass, nigger-wool, and countless other grasses that form a sod or turf do grow in the Great Plains region, in fact they are

[1] Abstract of paper presented before Am. Phil. Soc., April, 1921. Reprinted from "Science," Oct. 7, 1921, p. 338.

found interspersed with the bunch grasses on some types of soil, and in other localities one type of soil will produce bunch grass while another type of soil will produce grasses that form a sod. And all these grasses (or at least most of them) ripen in the fall and afford the most nutritious winter feed for stock.

In my opinion it is the soil rather than the climate that determines whether the vegetation be bunch grass or sod, while the climate determines whether the grass ripens before frost catches it or not. When we have much late rain the grass is apt to keep green until frost comes, and whenever this condition exists the stock does not thrive on the grass during the winter, but if there is not an excess of rainfall late in the summer the grass ripens, or turns brown, as Mr. Redway says, and this ripened grass is a much better feed for stock than cured hay. Stockmen say that the less hay they have to feed the better shape their stock is in in the spring, and when an exceptionally long and severe winter, or a shortage of suitable pasture, makes it necessary to feed hay for more than four months it is not possible to keep the stock healthy and hardy, while stock that is running at large at the same time is often in better shape than that which has been regularly fed upon good hay.

Mr. Redway says that "turf grass and bunch grass cannot live in the same locality." On my ranch I have some land which produces only bunch grass, other land which produces only turf grass, and still other land that is well sodded with buffalo grass but sprinkled through it are bunches of wheat grass that grow right up through the sod. In the same locality and climate I find that the heavy compact soils, such as gumbo, produce the bunch grass and do not sod, while the lighter soils that have a greater amount of sand or coarse shale mixed with the gumbo produce the kinds of grass that form a sod or turf, and those soils that are between the two types will produce both kinds of grass.

Mr. Redway also says: "Turf grass is highly nutritious fodder; but after it turns brown, a single shower leaches the nutrition out of it." I have a tract of land that is heavily sodded with buffalo sod, which is beyond question the best winter pasture in this locality. Recently I asked a neighboring stockman, who owns a 20,000-acre ranch joining mine, whether he thought this particular tract were not above the average grazing land of this locality, and he said that to his knowledge it had actually supported about twice as much stock to the acre during the past twenty-five years as the neighboring lands, and these neighboring lands contain a great deal of bunch grass.

Years ago I noticed that my work horses sought out this particular piece of land during the winter and stayed on about a ten-acre patch, although there were no fences to keep them. I worked one team about half the time all winter and always turned them loose by the hay stack, which was not fenced, but they would leave the hay and go to this "turf grass" and they kept in good condition without any hay or grain whatever.

From all of which I am of the opinion that Mr. Redway is absolutely wrong in his deduction that the climate determines whether

bunch or turf grass shall cover the ground in a given locality. I would like to hear from somebody who knows more about this matter than I do.—*Cola W. Shepard.*

FRUIT-FROST WORK OF THE U. S. WEATHER BUREAU IN THE PACIFIC STATES

When the fruit growers of the Rogue River Valley (Medford) in Oregon found out the frost service they had been getting for so many years was to be discontinued, they immediately took up the matter with Congress in such a vigorous way that the special appropriation of $9000 for the work was passed at the last minute, after it had been knocked out in committee. I was sent back to Medford from Davenport temporarily to handle the frost forecast work there during the 1921 spring season. The people showed their appreciation in a hundred different ways, which touched me greatly. They insisted on my staying at the University Club during the whole time I was in Medford, furnished a machine and otherwise cooperated in the work and treated me royally throughout.

The special appropriation allowed an extension of the work, and two assistants have been assigned to handle the frost forecasting service in southern California during the winter months. One will have headquarters at San Bernardino, Cal., to serve the citrus districts in the vicinity of Redlands and Riverside; the other will be located at Corona, to handle the work in the lemon groves which surround that place. There is a great deal of orchard heating at both these places, and when a suitable method for making accurate minimum temperature forecasts is worked out for both these places, as it is hoped will be the case before the first season is past, the work promises to be of great value to the fruit growers. The man assigned to handle the San Bernardino district is Eckley Ellison, who is coming from the San Francisco office. The second man is coming from Denver, but I have not been advised who is to come. The writer will have general supervision over the work at both districts, and will also handle the work at Pomona personally, as in the past. During the spring frost season it is proposed to send the two new men north to handle frost work in the deciduous orchards. It has been recommended that one man go to the Yakima Valley, in central Washington, and the other to the almond district, in the vicinity of Chico, Cal. The writer will probably handle the work at Medford, as in past seasons.

The frost season of 1921 at Medford was unusually severe, and losses in unprotected orchards were serious. In many ways the season was the most interesting that has passed during the time the Weather Bureau has been making detailed forecasts for the valley. The Plant Pathologist employed as County Agricultural Agent, Mr. Claude C. Cate, and the writer are cooperating in preparing a short article on the effects of different temperatures on the final crop of pears, the effects of heating under varying weather conditions, and various other aspects of the frost season. We hope to publish this before the next spring frost season opens. We have not decided as yet, where it will be published.—*Floyd D. Young.*